

# A STRATEGIC ENVIRONMENTAL QUALITY MONITORING PROGRAM FOR MICHIGAN'S SURFACE WATERS



MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY  
JANUARY 1997

## **PREFACE**

This report was prepared in fulfillment of Section 902 of House Bill No. 5589. The report also meets Targets established by the Michigan Department of Environmental Quality to achieve its mission and addresses the concerns and recommendations of the Office of the Auditor General (1995), the Michigan Environmental Science Board (1993), and the Michigan Mercury Pollution Prevention Task Force (1996).

Prepared By: Surface Water Quality and Land and Water Management Divisions of the  
Michigan Department of Environmental Quality

*Cover Photo: Davenport Creek, Epoufette, MI*

Additional information and copies of this report can be obtained by contacting the MDEQ, Great Lakes and Environmental Assessment Section at (517) 373-2190.



## TABLE OF CONTENTS

	<u>Page</u>
Executive Summary.....	iii
Section 1 Introduction.....	1
Section 2 Goals, Scope and Key Principles.....	4
2.1. Goals.....	4
2.2. Scope.....	5
2.3. Key Principles.....	5
Section 3 Monitoring Program Element Summaries and Funding Requirements.....	8
3.1. Fish Contaminants.....	12
3.1.1. General Information.....	12
3.1.2. Program Element Objectives.....	12
3.1.3. Measurement Endpoints.....	13
3.1.4. Monitoring Activities.....	13
3.2. Water Chemistry.....	15
3.2.1. General Information.....	15
3.2.2. Program Element Objectives.....	16
3.2.3. Measurement Endpoints.....	16
3.2.4. Monitoring Activities.....	16
3.3. Sediment Chemistry.....	19
3.3.1. General Information.....	19
3.3.2. Program Element Objectives.....	19
3.3.3. Measurement Endpoints.....	20
3.3.4. Monitoring Activities.....	20
3.4. Biological Integrity and Physical Habitat.....	21
3.4.1. General Information.....	21
3.4.2. Program Element Objectives.....	22
3.4.3. Measurement Endpoints.....	22
3.4.4. Monitoring Activities.....	23
3.5. Wildlife Contaminants.....	24
3.5.1. General Information.....	24
3.5.2. Program Element Objectives.....	24
3.5.3. Measurement Endpoints.....	25
3.5.4. Monitoring Activities.....	25
3.6. Bathing Beach Monitoring.....	27
3.6.1. General Information.....	27
3.6.2. Program Element Objectives.....	28
3.6.3. Measurement Endpoints.....	28
3.6.4. Monitoring Activities.....	28
3.7. Inland Lake Quality and Eutrophication.....	29
3.7.1. General Information.....	29
3.7.2. Program Element Objectives.....	29
3.7.3. Measurement Endpoints.....	30
3.7.4. Monitoring Activities.....	30

## TABLE OF CONTENTS

	<u>Page</u>
3.8. Stream Flow.....	32
3.8.1. General Information.....	33
3.8.2. Monitoring Activities.....	33
3.8.3. Measurement Endpoints.....	33
3.8.4. Monitoring Activities.....	33
3.9. Volunteer Monitoring.....	35
Section 4 Data Analysis and Communication.....	36
4.1. Reporting Raw Data.....	36
4.2. Summary Reports.....	37
Section 5 Integration With Other Programs and Agencies.....	40
5.1. Other State Programs and Agencies.....	40
5.2. Federal Agencies.....	40
5.3. Canadian Agencies.....	41
5.4. Native Americans.....	41
5.5. Local Government.....	41
5.6. Citizen Volunteer Monitoring.....	42
5.7. Contract Services.....	43

## **EXECUTIVE SUMMARY**

This report, “A Strategic Environmental Quality Monitoring Program For Michigan’s Surface Waters”, was prepared by the Surface Water Quality and Land and Water Management Divisions of the Department of Environmental Quality (MDEQ) in fulfillment of Section 902 of House Bill No. 5589. The report satisfies the Surface Water Quality Division’s (SWQD) long-term commitment to develop a comprehensive surface water quality strategy. It also addresses the criticisms and recommendations of the Office of the Auditor General (1995), the Michigan Environmental Science Board (1993), and the Michigan Mercury Pollution Prevention Task Force (1996), concerning the adequacy of current MDEQ surface water quality monitoring.

### **Goals**

This monitoring strategy satisfies four goals:

- Assess the current status and condition of individual waters of the state and determine whether standards are being met;
- Measure temporal and spatial trends in the quality of Michigan surface waters;
- Provide data to support MDEQ water quality protection programs and evaluate their effectiveness; and
- Detect new and emerging water quality problems.

### **Scope**

The strategy addresses the full range of Michigan's surface waters, including rivers, streams, inland lakes, and the Great Lakes and their connecting channels. It involves measuring water, sediment, fish, and wildlife tissue chemistry, stream flow, and monitoring the health and condition of associated aquatic communities and physical habitats.

The strategy recognizes that monitoring activities need to be planned and conducted in partnership with outside organizations. These partnerships will allow state funds to be leveraged with resources from other state, federal, local, and private sources.

### **Key Principles**

Several key principles essential for effective monitoring are incorporated into the report:

- Integrate and coordinate the use of scarce monitoring resources with those of other state, federal, and local agencies, tribes, Canadian organizations, universities, industry, environmental groups.
- Maximize the use of local units of government and citizen volunteers to monitor surface water quality.
- Schedule field studies and other data acquisition activities to be consistent with the SWQD's watershed permitting process.

- Use a tiered monitoring approach consisting of rapid assessment or screening studies at numerous sites and more intensive study designs at a smaller subset of prescreened sites.
- Generate monitoring data that are scientifically defensible and relevant to the decision-making process.
- Manage and report water quality data in a way that is meaningful and understandable to the intended audience.

## **Monitoring Activities**

The MDEQ monitoring capabilities for surface waters are severely restricted by current funding levels. In 1995, when the Auditor General report was prepared, only 1.0 state-funded FTE was available to the SWQD for environmental quality monitoring, and only 1.0 federally-funded FTE was available to the LWMD for lake quality and eutrophication monitoring. In 1996, the budget increase allocated by the legislature to eliminate the SWQD's NPDES permit backlog allowed the MDEQ to increase its monitoring commitment to 3.0 FTEs. Considering all federal funds (including restricted funds reserved for special, often short term projects) along with state funds, the MDEQ currently is able to devote only 12.2 FTEs and \$1,956,000 to monitoring Michigan's surface waters.

The enhanced monitoring program presented in this report is designed to satisfy MDEQ targets, achieve the monitoring goals listed in Section 2.1, and address the criticisms and recommendations of the Auditor General, the MESB and the Michigan Mercury Prevention Pollution Task Force. The funding requirements of the enhanced monitoring program demand that current monitoring resources be expanded to a level equivalent to 16 new person years and \$3,194,000. MDEQ recognizes that the funding needs of the enhanced monitoring program can only be secured by leveraging available state funds with those of outside entities. MDEQ intends to accomplish this by forming collaborative partnerships with other state and federal agencies, Canadian organizations, tribes, local governments, universities, industry, environmental groups, and citizen volunteers.

As part of the FY98 budget process, the MDEQ submitted a \$500,000 proposal to take the first step to enhance water quality monitoring in Michigan. This proposal was approved by the Michigan Department of Management and Budget. A portion of these state funds will be used by the SWQD to establish some of the collaborative partnerships described above.

The enhanced monitoring program consists of eight interrelated elements: Fish Contaminants, Water Chemistry, Sediment Chemistry, Biological Integrity and Physical Habitat, Wildlife Contaminants, Bathing Beach Monitoring, Inland Lake Quality and Eutrophication, and Stream Flow. The enhanced monitoring program includes 1.0 person year to coordinate and support citizen volunteer monitoring activities for the SWQD program elements. A comparison of the person year and funding requirements for the existing and enhanced monitoring programs is provided in the table on the following page.

A brief description of the enhanced monitoring program is presented below:

1. Fish Contaminants

The enhanced monitoring program expands fish contaminant monitoring activities. Support for fish advisories is maintained, while the effort devoted to native fish and caged fish contaminant trend monitoring increases substantially. More stations are monitored and the sensitivity of tests are improved. In addition, more staff time is devoted to the analysis of existing fish contaminant data along with water quality data, watershed characteristics, and land use data in order to refine fish consumption advisories, identify potential contaminant sources, and evaluate contaminant



**Budget Summary--Existing and Enhanced Monitoring Programs**

Program Element	Person Years		Funding*	
	Existing	Enhanced	Existing	Enhanced
Fish Contaminants	0.70	1.80	\$372,000	\$679,000
Water Chemistry	4.50	8.30	\$782,000	\$1,584,000
Sediment Chemistry	0.00	0.30	\$56,000	\$486,000
Biological Integrity and Physical Habitat	4.00	9.00	\$265,000	\$628,000
Wildlife Contaminants	0.00	0.80	\$0	\$405,000
Bathing Beach Monitoring	0.00	0.50	\$0	\$146,000
Inland Lake Quality and Eutrophication	1.00	4.50	\$106,000	\$529,000
Stream Flow	2.00	2.00	\$375,000	\$509,000
Citizen Volunteer Monitoring	0.00	1.00	\$0	\$78,000
<b>Total</b>	<b>12.20</b>	<b>28.20</b>	<b>\$1,956,000</b>	<b>\$5,044,000</b>
<b>Increase Above Existing</b>		<b>16.00</b>		<b>\$3,194,000</b>

\* MDEQ recognizes that these funding needs can only be secured by leveraging available state funds with those of outside entities through the formation of collaborative partnerships.

trends. The enhanced monitoring program also establishes a new spottail shiner trend monitoring effort for the Great Lakes and provides support for research into fish contaminant issues.

## 2. Water Chemistry

The enhanced monitoring program expands water chemistry monitoring in targeted watersheds, consistent with the SWQD's watershed permitting process, to support water quality protection programs. Toxic pollutant levels will be measured using low-level analytical techniques where appropriate. The program also expands and improves trend monitoring activities in Saginaw Bay, the Great Lakes connecting channels, and 20 other fixed river stations in the state. Trends in toxic and conventional pollutants will be assessed in these waterbodies. The enhanced monitoring program recommends flow stratified sampling to calculate pollutant loadings to the Great Lakes from major tributaries. Two tributaries will be sampled each year. The enhanced monitoring program also establishes a pesticide monitoring study in the Saginaw Bay watershed.

## 3. Sediment Chemistry

The enhanced monitoring program substantially expands sediment chemistry monitoring in targeted watersheds, in order to evaluate known or suspected sites of contamination, identify priority locations for remediation, and measure background sediment contaminant levels. The program also establishes sediment trend monitoring activities and sediment toxicity testing capabilities.

## 4. Biological Integrity and Physical Habitat

The goal of the enhanced monitoring program is to expand sampling coverage of Michigan waters from the current 12% of stream miles over five years to 80%. This increase in coverage will be accomplished by conducting more rapid assessments at some sites and increasing reliance on data collected by other agencies and citizen volunteers. The program commits SWQD to the development of a new procedure to assess biological integrity in nonwadable streams and rivers, as well as conduct special biological investigations, assess sedimentation, and investigate nuisance aquatic plant, algae, and bacterial slime conditions. The enhanced monitoring program establishes a biological trend monitoring effort for state waters and proposes a small grant program for biological integrity research.

## 5. Wildlife Contaminants

This would be an entirely new program element for SWQD. The enhanced program establishes bald eagle and mink trend monitoring activities. Tissue levels of organochlorine compounds, metals, and associated biomarkers will be measured to assess spatial and temporal contaminant trends and evaluate potential adverse effects from these contaminants. The strategy also proposes a snapping turtle pilot study to help determine the need for consumption advisories in state waters. It recommends contaminant analysis of herring gull eggs for trends, and establishes a pilot study in the Saginaw Bay watershed to measure contaminant levels in amphibians.

## 6. Bathing Beach Monitoring

The enhanced monitoring program establishes an entirely new program element to create and maintain a statewide database with information concerning bathing beach monitoring, standards violations, and beach closures. In addition, the enhanced program provides support for monitoring of selected public beaches during the summer months to measure compliance with E. coli standards.

## 7. Inland Lake Quality and Eutrophication

The enhanced monitoring program expands or establishes three related activities. The first, trophic status monitoring, is a modification and expansion of the current Self-Help citizen's volunteer monitoring program. This component is structured in a hierarchy of three levels of effort based on the number of indicators and the spatial and temporal scale of sampling. The second activity, lake quality assessment, is a continuation of a statewide inland lake monitoring program that will end in FY97 when federal funds are depleted. Minimum water quality, lake trophic status, regional lake quality, and attainment of water quality standards will be measured. The enhanced program also establishes a new long term monitoring program to measure lake quality variability and trends among ecoregions using minimally impacted reference lakes.

## 8. Stream Flow

The enhanced program continues and expands stream flow monitoring to support NPDES and nonpoint source program activities. These include estimates of 95% monthly exceedance flow and harmonic mean flow, and hydrological modeling and other technical assistance to entities involved in nonpoint source projects. The U.S. Geological Survey will be primarily responsible for data collection and distribution.

## 9. Volunteer Monitoring

Because many of the program elements recommend the use of citizen volunteer monitoring, SWQD proposes to devote staff time to coordinate and support a volunteer program. Responsibilities include organizing and training volunteers, providing equipment, developing and implementing quality assurance procedures, analyzing and reporting data, and giving presentations to volunteer groups.

## **Data Analysis and Communication**

An effective water quality monitoring program requires that data are analyzed and communicated in meaningful and timely ways to intended audiences. Raw data generated by the monitoring program elements will be entered into an existing networked, distributed, or centralized database. Where possible, data sets will be placed in a geographic information system (GIS) compatible format.

The enhanced monitoring program will lead to the production of several reports to ensure that the data are communicated effectively to intended audiences.

## **Integration With Other Programs and Agencies**

Efficient use of limited resources requires that surface water quality monitoring activities are integrated. Many agencies and groups, from the federal government to individual citizens, have monitoring responsibilities and interests. The MDEQ will work with other entities to select sites and fulfill data needs, in particular other state and federal agencies, Canadian organizations, tribes, local government, industry, environmental groups, and citizen volunteers. In addition, collaborative teams will look for opportunities where the use of contractual services is the most efficient and cost-effective means to accomplish the task.

## **Conclusion**

Effective environmental monitoring improves natural resource management, directly impacting our ability to maintain sustainable ecosystems, protect public health, and support a healthy economy. MDEQ is confident that the strategic environmental quality monitoring program described in this report, when implemented and funded in partnership with other entities, will improve the monitoring capabilities of MDEQ and all other parties with monitoring responsibilities in Michigan.

## **SECTION 1 INTRODUCTION**

In the 1970s, water pollution control efforts were directed at correcting problems that primarily involved point source discharges. The pollutants of interest were relatively easy to measure and samples could be taken upstream and immediately downstream of the facility, and any differences were easily attributable to that source. Water quality managers are now faced with more subtle and complicated problems and issues that demand more sophisticated monitoring techniques and approaches. While continuing to evaluate point sources, Michigan's water quality monitoring programs must now assess the environmental impacts of nonpoint sources that are diverse and more difficult to isolate. Because bioaccumulative chemicals (e.g. dioxins, PCBs, etc.) can have serious impacts on aquatic systems when present at extremely low concentrations, monitoring techniques must be very sophisticated and sensitive. Water quality monitoring programs need to be improved to more effectively address changing environmental conditions and issues.

Effective environmental monitoring is an essential component of the Michigan Department of Environmental Quality's (MDEQ) mission and goals. A key Target established by MDEQ to achieve its Mission is to: "Develop a comprehensive system to measure environmental improvements and establish environmental baselines". The MDEQ clearly recognizes that comprehensive water quality monitoring is necessary to improve natural resource management, maintain sustainable ecosystems, protect public health, and support a healthy economy in Michigan. This report recommends a strategy for statewide water quality monitoring to support sound water quality decision-making at all levels of government.

Most surface water quality monitoring by the MDEQ is done by two divisions. The Surface Water Quality Division (SWQD) is responsible for monitoring the environmental quality of the state's rivers and streams, inland lakes, and the Great Lakes including their connecting channels. Monitoring activities include biological surveys to measure the integrity of fish and invertebrate communities and physical habitat condition, water and sediment chemical sampling and analysis, and fish contaminant analysis. The Land and Water Management Division (LWMD) is responsible for measuring stream flow and monitoring the quality and eutrophication status of inland lakes. A number of other agencies and groups also contribute to water quality evaluations, including the Michigan Department of Natural Resources (MDNR), Michigan Department of Agriculture (MDA), U.S. Environmental Protection Agency (USEPA), U.S. Geological Survey (USGS), U.S. Fish and the Wildlife Service (USFWS), Environment Canada, the Ontario Ministry of Environment, tribes, county and city governments, universities and colleges, industry, environmental groups, and citizen volunteers. The challenge to all of these agencies and groups is to ensure that monitoring activities and resources are integrated, and to avoid duplication of effort.

Comprehensive, viable monitoring programs require long-term funding commitments. However, in recent years, state funds devoted to surface water quality monitoring have greatly declined. While other funds for monitoring have been secured from outside sources, particularly the USEPA, these funds have not offset the decrease in state funds, resulting in up to an 80% reduction in some MDEQ monitoring

activities. For example, in 1990, the SWQD had an extensive fixed station monitoring network, in which water quality samples were regularly collected from over 100 stations throughout the state. This program was eliminated in 1994, except for 13 stations on the Detroit River and 8 stations along Saginaw Bay. The fish contaminant and biological integrity components of the MDEQ's monitoring program also endured substantial funding reductions in the 1990s. The inland lakes monitoring program that has been in existence at various levels for nearly 25 years will end in 1997 when federal Clean Lakes Program funds are depleted.

Several groups have recently noted the importance of a strong water quality monitoring program, and have pointed out the effects of these reductions on the MDEQ's monitoring capability. The lack of sufficient funds for the SWQD to implement an adequate monitoring program was identified in a March 8, 1995, field audit report by the Auditor General's office. The report states that due to the reduced level of monitoring:

“...the division does not have a firm basis to assess overall water quality and determine if it has improved, degraded, or remained the same. The division does not have a firm basis for decision making and prioritizing its efforts. Without this base knowledge, the division has limited ability to operate an effective surface water quality monitoring program.”

The Michigan Environmental Science Board (MESB) also noted the importance of monitoring in a 1993 report, stating that:

“...regulation must be supplemented with a monitoring program capable of establishing and tracking changing trends in contaminants.”

The Michigan Mercury Pollution Prevention Task Force recommended in their 1996 final report that the MDEQ should:

“...dedicate funding resources to institute and maintain a surveillance and monitoring system in order to quantify mercury exposure and measure changes in exposure.”

The final impetus for the development of this strategic environmental quality monitoring program came from House Bill 5589, Section 902. This Bill states that:

“...the department shall by January 1, 1997 prepare and report to the senate and house appropriations committees on a comprehensive water quality monitoring program that responds to the report of the auditor general..”

The Bill also states that the water quality monitoring report shall:

“...specify the level of funding necessary to provide a monitoring program adequate to measure the overall water quality and trends in water quality of Michigan's water resources, and shall specify how the department proposes to cooperate with local units of government, other state

agencies, nonprofit organizations, and citizen volunteer monitoring programs to assure the most cost-effective and statistically valid method of measuring water quality in the state.”

This report fulfills the requirements of House Bill 5589, responds to the criticisms and recommendations of the Office of the Auditor General, MESB and the Michigan Mercury Pollution Prevention Task Force relating to water quality monitoring, and satisfies the SWQD’s long-term commitment to develop an enhanced surface water quality monitoring strategy. Section 2 of this report identifies the goals and defines the scope of the monitoring strategy and discusses key principles on which the strategy is based. Section 3 summarizes the program elements encompassed by the enhanced monitoring program, and includes brief descriptions of specific monitoring activities and their anticipated cost. Section 4 describes the data products and reports that the strategy will generate, along with target audiences. Section 5 reviews how the SWQD will coordinate and integrate monitoring activities with those of federal and state agencies, Canadian organizations, tribes, local governments, industry, environmental groups, and citizen volunteers. Given the limited resources available, it is critical that all monitoring entities work together to ensure efficient use of resources.

## SECTION 2 GOALS, SCOPE AND KEY PRINCIPLES

### 2.1. Goals

This environmental quality monitoring strategy is based on goals and objectives, measurement endpoints (or indicators), and specific monitoring activities. This section describes the strategy's four primary goals, while the objectives, measurement endpoints, and specific monitoring activities are covered in Section 3.

**Goal 1: Assess the current status or condition of individual waters of the state and determine whether standards are being met.**

Chemical, biological, and toxicological investigations will be performed on a majority of watersheds over a five year period to determine whether the requirements of the Michigan Water Quality Standards and Great Lakes Initiative are being attained.

**Goal 2: Measure temporal and spatial trends in the quality of Michigan surface waters.**

Temporal and spatial water quality trends will be evaluated by measuring levels of indicator parameters in water, fish, sediment and wildlife samples collected from long-term monitoring stations at set intervals. Biological integrity and physical habitat quality changes occurring within and between watersheds also will be assessed qualitatively by comparing monitoring data generated in different basin years. Because of the need to distinguish natural water quality variability from water quality changes caused by humans, the trend monitoring aspects of this strategy have been carefully designed. Trend data are important for measuring the effects of human activity on the aquatic environment and whether water quality protection programs lead to long-term improvements.

**Goal 3: Provide data to support MDEQ water quality protection programs and evaluate their effectiveness.**

All water quality programs benefit from, and often require, timely ambient water quality data, especially NPDES permits, nonpoint source, fisheries management, lake management, community health, and site remediation activities. In addition, follow-up monitoring is needed to measure whether actions taken by these programs improve the ecological integrity of a waterbody. It is critical that program actions are evaluated to ensure that limited resources are used effectively and that economic costs are not incurred without corresponding environmental benefit.

**Goal 4: Detect new and emerging water quality problems.**

It is more cost-effective to prevent environmental degradation than to remediate sites after degradation has occurred. Emerging water quality problems include the presence of a new chemical in surface water whose adverse impacts have yet to be identified, nutrient enrichment and accelerated eutrophication, the



occurrence of nuisance plant conditions or exotic species in a waterbody, or the loss of critical habitat essential to the maintenance of a healthy aquatic community. In each case, early warning of the potential problem through an effective monitoring program would allow the MDEQ to take action before a problem develops.

## **2.2. Scope**

This strategy addresses all of Michigan's surface waters, including rivers, streams, inland lakes, and the Great Lakes and their connecting channels. The strategy also describes activities to measure the chemical character of the water, sediments, and fish and wildlife tissues, and to monitor the health and condition of associated aquatic communities and physical habitats. The strategy also describes activities necessary to accurately characterize stream flow.

This strategy covers the monitoring activities of two MDEQ divisions (SWQD and LWMD). Considerable emphasis is given to identifying how the MDEQ will work cooperatively with other state and federal agencies, local governments, Canadian organizations, tribes, universities, industry, environmental groups, and citizen volunteers.

## **2.3. Key Principles**

This strategy incorporates several key principles considered by MDEQ to be essential to effective monitoring. These principles are depicted in Figure 2.1 and described in more detail in the remainder of this section.

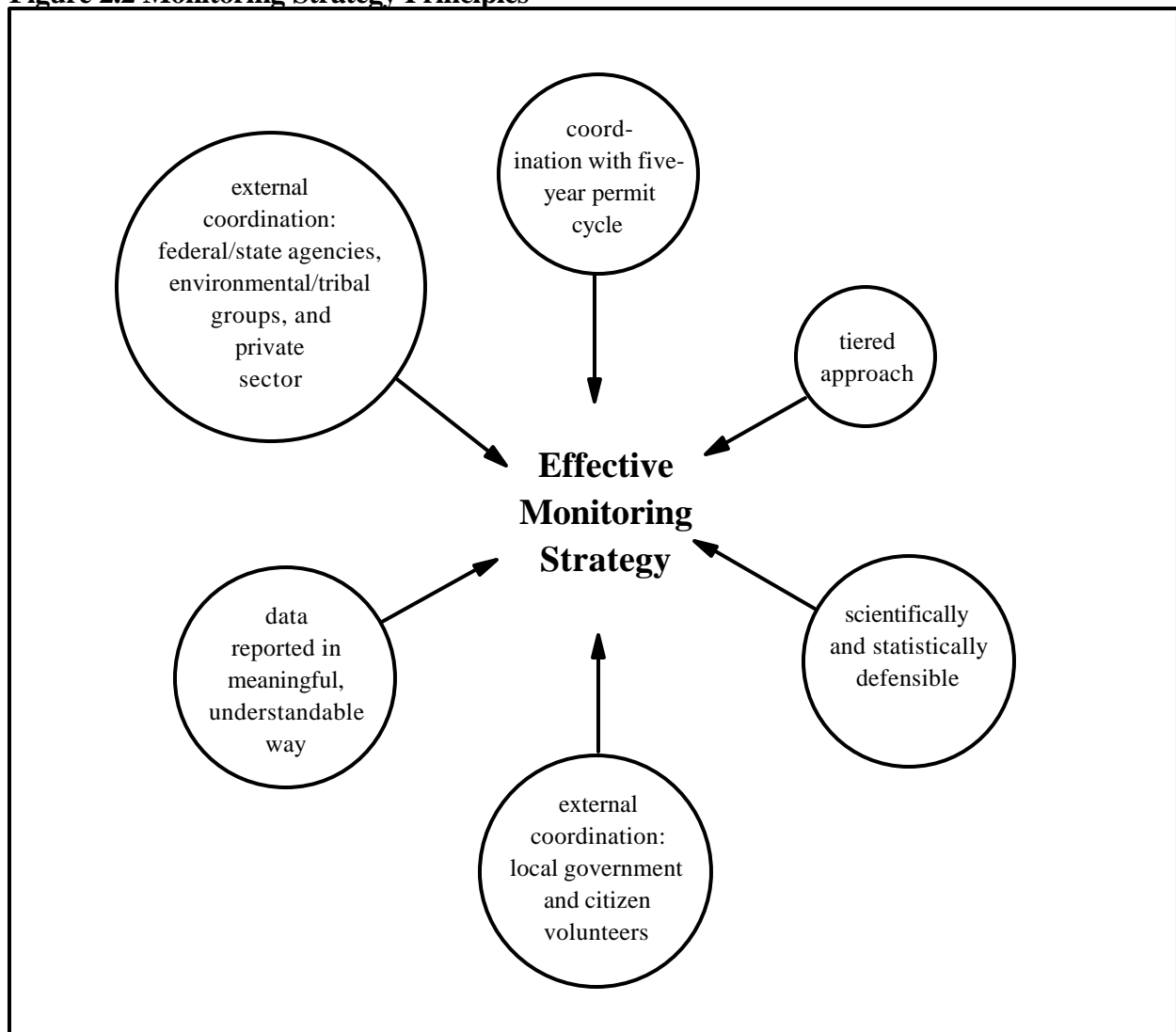
### **Principle 1: Integrate and coordinate the use of scarce monitoring resources with those of other agencies and groups.**

The scarcity of funds dedicated to monitoring demands that MDEQ work closely with other entities to ensure the broadest possible coverage of Michigan's surface waters. MDEQ will collaborate with other monitoring organizations to plan and implement watershed monitoring activities.

### **Principle 2: Maximize the use of local units of government and citizen volunteers to monitor surface water quality.**

Local units of government and citizen volunteers can play an important role in monitoring surface water quality. By using local governments and citizens in the monitoring program, more waters can be assessed. When local governments and citizen volunteers actually collect the data and see problems, they are more likely to take the necessary steps to address them. Screening-level monitoring by active, competent citizen volunteers will allow more time for MDEQ professionals to address complex problems and issues. The monitoring strategy depends upon citizen volunteer involvement and considerable emphasis is given in the strategy to ensure that these groups receive proper support, guidance and information feedback.

**Figure 2.2 Monitoring Strategy Principles**



**Principle 3: Schedule field studies and other data acquisition activities to be consistent with the SWQD's watershed permitting process.**

Ideally, the SWQD issues all NPDES permits in a watershed during the same year. This is done on a five year cycle, meaning that each major watershed is revisited every five years. Because ambient water quality data are needed to support the NPDES program, the timing of data collection and analysis needs to be such that data for each watershed are available prior to the initiation of the permit development process. Consequently, many of the monitoring activities proposed for this strategy are also on a five year cycle, with monitoring of a watershed occurring two or three years prior to the actual permit issuance year.

**Principle 4: Use a tiered monitoring approach which may consist of rapid assessment or screening studies at numerous sites and more intensive study designs at a smaller subset of prescreened sites.**

Wherever possible, MDEQ will use rapid assessments or screening studies, possibly performed by other entities such as citizen volunteers, to initially evaluate the water quality status of a waterbody. If the initial screening data suggest that a potential problem exists, then the site will be revisited and more detailed monitoring performed by MDEQ staff to verify the problem and determine the exact nature and source(s) of the problem. This tiered monitoring approach will lead to the assessment of more waters across the state each year, and allow the MDEQ to focus limited monitoring resources on those waters with the most pressing needs.

**Principle 5: Generate monitoring data that are scientifically and defensible and relevant to the decision-making process.**

All of the monitoring activities described in this strategy are linked to specific goals and objectives, and are established to be consistent with sound scientific and statistical concepts. Considerable emphasis is given to ensuring that the quality of the monitoring data is sufficient to support sound decision-making. A performance-based methods system is also applied to ensure comparable data are produced that can be integrated from a variety of sources across many scales.

**Principle 6: Manage and report water quality data in a way that is meaningful and understandable to the intended audience.**

For monitoring information to be truly useful, it must be managed properly and reported to intended audiences in a meaningful and timely manner. The strategy commits to data automation and the establishment of data format standards to ensure that the water quality data are easily accessible and understandable to primary and secondary users. The strategy recognizes that different levels of detail are needed depending on the audience and several types of data reports will be produced. Data management and reporting are discussed in more detail in Section 4.

### **SECTION 3**

#### **MONITORING PROGRAM ELEMENT SUMMARIES AND FUNDING REQUIREMENTS**

MDEQ monitoring capabilities for surface waters are severely restricted by current funding levels. In 1995, when the Auditor General report was prepared, only 1.0 state-funded FTE was available to the SWQD for environmental quality monitoring, and only 1.0 federally-funded FTE was available to the LWMD for lake quality and eutrophication monitoring. In 1996, the budget increase allocated by the legislature to eliminate the SWQD's NPDES permit backlog allowed the MDEQ to increase its monitoring commitment to 3.0 state-funded FTEs. Considering all federal funds (including restricted funds reserved for special, often short term projects) along with the above state funds, the MDEQ currently is able to devote only 12.2 FTE and \$1,956,000 to monitoring Michigan's surface waters.

The enhanced monitoring program presented in this report is designed to satisfy MDEQ targets, achieve the monitoring goals listed in Section 2.1, and address the criticisms and recommendations of the Auditor General, the MESB and the Michigan Mercury Pollution Prevention Task Force. The funding requirements of the enhanced monitoring program demand that current monitoring resources be expanded to a level equivalent to 16 new person years and \$3,194,000. MDEQ recognizes that the funding needs of the enhanced monitoring program can only be secured by leveraging available state funds with those of outside entities. MDEQ intends to accomplish this by forming collaborative partnerships with other state and federal agencies, Canadian organizations, tribes, local governments, universities, industry, environmental groups, and citizen volunteers.

As part of the FY98 budget process, the MDEQ submitted a \$500,000 proposal to take the first step to enhance water quality monitoring in Michigan. This proposal was approved by the Michigan Department of Management and Budget. A portion of these state funds will be used by the SWQD to establish some of the collaborative partnerships described above.

The enhanced monitoring program consists of eight interrelated elements: Fish Contaminants, Water Chemistry, Sediment Chemistry, Biological Integrity and Physical Habitat, Wildlife Contaminants, Bathing Beach Monitoring, Inland Lake Quality and Eutrophication, and Stream Flow. The enhanced monitoring program includes 1.0 person year to coordinate and support citizen volunteer monitoring activities for the SWQD program elements.

Descriptive summaries of each program element are provided in the remainder of this section. Specific monitoring activities within each program element are presented in priority order to facilitate alternative strategy implementation. More detailed comparisons of the existing and enhanced monitoring program resource needs (organized by program element) are presented in Tables 3.1 and 3.2.

**Table 3.1. Budget Summary--Existing and Enhanced Monitoring Programs**

Program Element	Person Years		Funding*	
	Existing**	Enhanced	Existing**	Enhanced
Fish Contaminants	0.70	1.80	\$372,000	\$679,000
Water Chemistry	4.50	8.30	\$782,000	\$1,584,000
Sediment Chemistry	0.00	0.30	\$56,000	\$486,000
Biological Integrity and Physical Habitat	4.00	9.00	\$265,000	\$628,000
Wildlife Contaminants	0.00	0.80	\$0	\$405,000
Bathing Beach Monitoring	0.00	0.50	\$0	\$146,000
Inland Lake Quality and Eutrophication	1.00	4.50	\$106,000***	\$529,000
Stream Flow	2.00	2.00	\$375,000	\$509,000
Citizen Volunteer Monitoring	0.00	1.00	\$0	\$78,000
<b>Total</b>	<b>12.20</b>	<b>28.20</b>	<b>\$1,956,000</b>	<b>\$5,044,000</b>
<b>Increase Above Existing</b>		<b>16.00</b>		<b>\$3,194,000</b>

\* MDEQ recognizes that the funding needs of the enhanced monitoring program can only be secured by leveraging available state funds with those of outside entities.

\*\* Existing person years and funding include both federal and state funds.

\*\*\* These are federal funds that will no longer be available after 1997. Therefore, the \$106,000 was included in the row labeled "Increase Above Existing".

**Table 3.2 Funding Needs for the Enhanced Monitoring Program**

<b>Fish Contaminants</b>		Person Years	Person Year \$	Equipment/ Analysis \$	Travel \$	Total \$*
1	Edible Fish Portion Monitoring	0.90	\$59,000	\$249,000	\$1,000	\$309,000
2	Native Fish Trend Monitoring	0.40	\$26,000	\$124,000	\$1,000	\$151,000
3	Caged Fish or Mussel Studies	0.40	\$26,000	\$58,000	\$1,000	\$85,000
4	Spottail Shiner Monitoring	0.10	\$7,000	\$26,000	\$1,000	\$34,000
5	Research Grants	0.00	\$0	\$100,000	\$0	\$100,000
<b>Subtotal</b>		1.80	\$118,000	\$557,000	\$4,000	\$679,000
<b>Water Chemistry</b>						
1	5-Year Basin Sampling	4.50	\$293,000	\$373,000	\$11,000	\$677,000
2	Trend Monitoring	2.30	\$150,000	\$370,000	\$4,000	\$524,000
3	Tributary Loadings	0.50	\$33,000	\$143,000	\$13,000	\$189,000
4	Saginaw Bay Pesticide Study	1.00	\$65,000	\$123,000	\$6,000	\$194,000
<b>Subtotal</b>		8.30	\$541,000	\$1,009,000	\$34,000	\$1,584,000
<b>Sediment Chemistry</b>						
1	5-Year Basin Sampling	0.25	\$16,000	\$247,000	\$1,000	\$264,000
2	Trend Monitoring (River & Inland Lake)	0.05	\$4,000	\$97,000	\$1,000	\$102,000
3	Toxicity Tests	0.00	\$0	\$120,000	\$0	\$120,000
<b>Subtotal</b>		0.30	\$20,000	\$464,000	\$2,000	\$486,000
<b>Biological Integrity and Physical Habitat</b>						
1	Wadable and Nonwadable Biosurveys	8.00	\$520,000	\$0	\$15,000	\$535,000
2	Trend Monitoring	1.00	\$65,000	\$0	\$3,000	\$68,000
3	Research Grants	0.00	\$0	\$25,000	\$0	\$25,000
<b>Subtotal</b>		9.00	\$585,000	\$25,000	\$18,000	\$628,000
<b>Wildlife Contaminants</b>						
1	Bald Eagle Monitoring	0.20	\$13,000	\$102,000	\$2,000	\$117,000
2	Mink Monitoring	0.20	\$13,000	\$119,000	\$2,000	\$134,000
3	Herring Gull Monitoring	0.20	\$13,000	\$47,000	\$1,000	\$61,000
4	Amphibian Pilot Study	0.10	\$7,000	\$32,000	\$1,000	\$40,000
5	Snapping Turtle Pilot Study	0.10	\$7,000	\$45,000	\$1,000	\$53,000
<b>Subtotal</b>		0.80	\$53,000	\$345,000	\$7,000	\$405,000
<b>Bathing Beach Monitoring</b>						
1	Database Development & Maintenance	0.50	\$33,000	\$113,000	\$0	\$146,000
<b>Subtotal</b>		0.50	\$33,000	\$113,000	\$0	\$146,000
<b>Inland Lake Quality and Eutrophication</b>						
1	Trophic Status	1.10	\$72,000	\$60,000	\$6,000	\$138,000
2	Lake Quality Assessment	1.10	\$72,000	\$51,000	\$5,000	\$128,000
3	Long Term Lake Trends	2.30	\$150,000	\$100,000	\$13,000	\$263,000
<b>Subtotal</b>		4.50	\$294,000	\$211,000	\$24,000	\$529,000
<b>Stream Flow</b>						
1	NPDES Support	1.00	\$65,000	\$0	\$0	\$65,000
2	Nonpoint Source Technical Assistance	1.00	\$65,000	\$0	\$0	\$65,000
3	Long Term Flow	0.00	\$0	\$334,000	\$0	\$334,000
4	Short Term Flow	0.00	\$0	\$45,000	\$0	\$45,000
<b>Subtotal</b>		2.00	\$130,000	\$379,000	\$0	\$509,000
<b>Citizen Volunteer Monitoring</b>						
Organize & Train Volunteers		1.00	\$65,000	\$10,000	\$3,000	\$78,000

<b>Grand Total</b>	<b>28.20</b>	<b>\$1,839,000</b>	<b>\$3,113,000</b>	<b>\$92,000</b>	<b>\$5,044,000</b>
<b>Increase Above Existing</b>	<b>16.00</b>	<b>\$1,040,000</b>			<b>\$3,194,000</b>

\* MDEQ hopes to secure this funding by leveraging available state funds with those of outside entities through the formation of collaborative partnership

### 3.1. FISH CONTAMINANTS

#### 3.1.1. General Information

The Michigan Fish Contaminant Monitoring Program (FCMP) has been in existence since 1980. Fish contaminant data are used to determine whether fish from the waters of the state are safe for human and wildlife consumption, and as a surrogate measure of bioaccumulative contaminants in surface water. Prior to 1986, fish contaminant monitoring studies were conducted primarily to address specific problems. In 1986, the FCMP was redesigned to allow a better assessment of chemical contamination in fish from the state's surface waters.

Recent funding cuts have caused a reduction in the number of sites monitored and fish collected through the FCMP. The activities proposed below for this program element would enhance the ability to evaluate temporal and spatial trends in fish contaminant levels. The need for more trend data was clearly identified by the Auditor General. Funding requirements are described in Table 3.3.

**Table 3.3. Existing and Enhanced Funding Levels-Fish Contaminants. Number of Person Years Are In Parentheses.**

Budget Item	Existing (FY97)	Enhanced
Personnel	\$46,000 (0.7)	\$118,000 (1.8)
Analysis/Equipment	\$323,000	\$557,000
Travel	\$3,000	\$4,000
Total	\$372,000	\$679,000
Increase		\$307,000

#### 3.1.2. Program Element Objectives

The Fish Contaminants program element addresses seven objectives:

- Objective 1. Determine whether fish from the waters of the state are safe for human consumption.
- Objective 2. Determine whole fish contaminant concentrations in the waters of the state.
- Objective 3. Determine whether the levels of contaminants in fish are changing with time.
- Objective 4. Assist in the identification of waters that may exceed standards and target additional monitoring activities.
- Objective 5. Evaluate the overall effectiveness of MDEQ programs in reducing levels of contaminants in fish.
- Objective 6. Identify waters of the state that are high quality.
- Objective 7. Determine if new chemicals are bioaccumulating in fish from Michigan waters.



### 3.1.3. Measurement Endpoints

The chemical character of fish from the waters of the state will be assessed by analyzing fillets or whole body samples for bioaccumulative organic chemicals and mercury. Caged fish or mussels also will be analyzed for these chemicals and serve as surrogate measures of bioaccumulative pollutants in the exposed waters.

### 3.1.4. Monitoring Activities

The specific monitoring activities proposed under this program element fall into six categories:

#### **Edible Fish Portion Monitoring**

Each year, approximately 500 edible portion fish samples will be collected from 40-50 sites throughout the state and analyzed for indicator chemicals. The fish contaminant data will be compared to Michigan Department of Community Health (MDCH) fish consumption advisory trigger levels to determine whether fish advisories need to be established or removed. Fish contaminant data will be analyzed along with water quality data, watershed characteristics, and land use data in order to refine fish consumption advisories, identify potential contaminant sources, and evaluate contaminant trends.

Existing vs. New Activity: This monitoring activity is currently performed at a comparable level by the SWQD, except that the proposed enhancement expands the level of effort targeted for analysis of existing data.

Anticipated Cost: \$309K (\$59K for 0.9 person years, \$249K analytical and equipment, \$1K travel).

#### **Native Fish Trend Monitoring**

Over two years, fish will be collected from 27 fixed trend locations representing inland lakes, rivers and the Great Lakes and their connecting channels and analyzed for indicator chemicals. This monitoring effort will be used to evaluate temporal and spatial trends in fish contaminant levels throughout the state. MDEQ will continue to work cooperatively with the USEPA, U.S. Food and Drug Administration (USFDA), USGS, and other Great Lake states to implement two other trend monitoring efforts: (1) USEPA/USGS Great Lakes Whole Fish Trend Monitoring and (2) Federal/State Chinook and Coho Salmon Fillet Trend Monitoring.

Existing vs. New Activity: This trend monitoring activity is currently performed at a reduced level of effort by the SWQD. The proposed enhancement expands the number of fish samples collected at each site and increases the sampling frequency of sites to every other year.

Anticipated Cost: \$151K (\$26K for 0.4 person years, \$124K analytical and equipment, \$1K travel).

## **Caged Fish or Mussel Studies**

Consistent with the SWQD watershed permitting process, bioconcentration in caged fish or mussels will be measured in four watersheds each year. These studies will involve placement of cages at different locations within a given watershed, including river mouths. Differences in tissue concentrations between the sites will be used to measure the effectiveness of water quality protection efforts and focus new remedial or monitoring efforts. Repeated monitoring will be performed in the watersheds as necessary to assess trends.

Existing vs. New Activity: This monitoring activity enhances the existing caged fish river mouth trend monitoring activity by expanding the number of locations within a watershed that are assessed.

Anticipated Cost: \$85K (\$26K for 0.4 person years, \$58K analytical and equipment, \$1K travel).

## **Spottail Shiner Monitoring**

Young-of-the-year spottail shiners will be collected from sites located in the nearshore waters of the Great Lakes and analyzed for indicator chemicals. This monitoring effort will determine whether fish contaminant levels are decreasing in response to water quality protection efforts. Spottail shiner monitoring will be coordinated with a similar monitoring program implemented by the Ontario Ministry of the Environment.

Existing vs. New Activity: This monitoring activity is not currently being performed and represents a new initiative.

Anticipated Cost: \$34K (\$7K for 0.1 person years, \$26K analytical and equipment, \$1K travel).

## **Research Grants**

Establish a small grant program to fund research by universities (or other non-profit groups) relevant to fish contaminant monitoring. Research topics could include development of new chemical screening methods, fish movement studies, effects data, and development of site specific bioaccumulation factors.

Existing vs. New Activity: This research grant program represents a new initiative.

Anticipated Cost: \$100K (\$100K in grant funds).

## **3.2. WATER CHEMISTRY**

### **3.2.1. General Information**

All monitoring activities performed by the SWQD involving the measurement of conventional and toxic pollutant levels in ambient waters fall under this program element. Water chemistry monitoring performed on inland lakes by the LWMD is addressed by the Inland Lake Quality and Eutrophication program element in Section 3.7.

Historically, limitations in analytical quantification levels and the funding reductions of the early 1990's have restricted the overall effectiveness of MDEQ water chemistry monitoring activities. The number of sites where long-term water quality samples are collected declined from over 100 sites to just 13 sites on the Detroit River and 8 sites on Saginaw Bay. However, recent technological advances (particularly the availability of low-level analytical methods for toxic organics and trace metals) now make it possible to collect water chemistry information, at a reasonable cost, that is directly relevant to many of the priority issues and problems affecting Michigan surface waters. The proposed enhancements for this program element will lead to increased support for all MDEQ programs as well as improve the ability to detect water quality trends throughout the state. Funding requirements are outlined in Table 3.4.

**Table 3.4. Existing and Enhanced Funding Levels--Water Chemistry. Number of Person Years Are In Parentheses.**

Budget Item	Existing (FY97)	Enhanced
Personnel	\$292,000 (4.5)	\$541,000 (8.3)
Analysis and Equipment	\$479,000	\$1,009,000
Travel	\$11,000	\$34,000
Total	\$782,000	\$1,584,000
Increase		\$802,000

### 3.2.2. Program Element Objectives

The Water Chemistry program element addresses eight objectives:

- Objective 1. Determine whether the chemical character of the waters of the state is suitable for indigenous aquatic life, wildlife and human health, based on standards.
- Objective 2. Determine whether the waters of the state are safe for agricultural use, based on standards.
- Objective 3. Determine whether nutrients are present in the waters of the state at levels that will not stimulate the growth of nuisance aquatic plants, algae, or slimes.
- Objective 4. Determine whether the chemical character of the waters of the state is changing with time.
- Objective 5. Determine the capacity of a waterbody to assimilate waste in support of Total Maximum Daily Load (TMDL) development, the NPDES permit program and venting groundwater mixing zone determinations.
- Objective 6. Evaluate the overall effectiveness of MDEQ programs in protecting the waters of the state from conventional and toxic pollutants.
- Objective 7. Identify waters of the state that are high quality and those that are not meeting standards.
- Objective 8. Identify new chemicals impairing waters of the state.

### 3.2.3. Measurement Endpoints

The chemical character of the waters of the state will be assessed by measuring one or more of the following indicator parameters in water samples collected throughout the state: metals, organic chemicals, dissolved oxygen, temperature, pH, total suspended solids, total dissolved solids, biochemical oxygen demand, chlorides, alkalinity/hardness, ammonia, nitrite- and nitrate- nitrogen, total phosphorus, and E. coli.

The suite of indicator parameters to be measured at any particular site depends upon the reason(s) that site was selected for monitoring.

### 3.2.4. Monitoring Activities

The specific monitoring activities proposed for inclusion under the Water Chemistry program element fall into four categories:

#### **Five Year Basin Sampling**

Each year, targeted watersheds will be sampled at selected sites for conventional and toxic pollutants to: (a) provide assistance in the development of water quality-based effluent limits for effluents and venting groundwater; (b) identify sites where standards are exceeded; (c) identify high quality sites; (d) develop complex TMDLs; (e) evaluate the effectiveness of Best Management Practices and watershed management plans; (f) support enforcement actions; (g) develop nutrient budgets for inland lakes; (h) examine pesticide concentrations and impacts; and (i) investigate new emerging water chemistry problems. Watersheds will be targeted for sampling consistent with SWQD's watershed permitting process.

Existing vs. New Activity: This monitoring activity is currently performed at a reduced level of effort by the SWQD. The proposed enhancement substantially expands the number of sites to be monitored and requires the use of low-level analytical techniques to monitor select toxic pollutants (i.e. mercury, PCB).

Anticipated Cost: \$677K (\$293K for 4.5 person years; \$373K analytical and equipment, \$11K travel).

#### **Trend Monitoring**

A water chemistry trend monitoring program will be implemented to measure water quality changes over time and evaluate the effectiveness of water pollution control efforts. This trend monitoring program will consist of: (1) each year, sample Saginaw Bay for total phosphorus, other nutrients, and metals at eight stations (three different months); (2) each year, sample the headwaters and mouth of the Great Lakes connecting channels (St. Mary's River, St. Clair River and Detroit River) monthly for selected toxic and conventional pollutants; and (3) each year, sample 20 fixed river stations throughout Michigan at low flow for selected toxic and

conventional pollutants. Low-level analytical techniques will be used as necessary to measure toxic pollutants.

Existing vs. New Activity: Saginaw Bay is currently being monitored by SWQD and no additional funding support is requested for this activity. The Detroit River currently is regularly sampled for trends by SWQD, though not using low-level analytical techniques. Monitoring of the other connecting channels and fixed river stations is not currently being performed and represents a new initiative.

Anticipated Cost: \$524K (\$150K for 2.3 person years; \$370K analytical and equipment; \$4K travel).

### **Tributary Loadings**

Every year, two major Great Lakes tributaries will be monitored for selected toxic and conventional pollutants using a flow stratified sampling design and low-level analytical techniques. This monitoring activity will determine chemical loading rates from these tributaries. Different tributaries will usually be sampled each year; however, repeat sampling will be scheduled as necessary to assess trends.

Existing vs. New Activity: This monitoring activity is not currently being performed and represents a new initiative.

Anticipated Cost: \$189K (\$33K for 0.5 person years, \$143K analytical and equipment, \$13K travel).

### **Saginaw Bay Pesticide Study**

The Saginaw Bay watershed and a control watershed will be sampled intensively throughout one growing season for pesticides to: (a) determine whether standards exceedances exist, (b) assess the need for improved pesticide use management practices, and (c) determine whether pesticide monitoring needs to be scheduled for other high pesticide use watersheds in the state.

Existing vs. New Activity: This monitoring activity is not currently being performed and represents a new initiative.

Anticipated Cost: \$194K (\$65K for 1.0 person years, \$123K analytical and equipment, \$6K travel).

## **3.3. SEDIMENT CHEMISTRY**

### **3.3.1. General Information**

Contaminated sediments can directly impact bottom-dwelling organisms and represent a continuing source of toxic substances to the aquatic environment that may impact wildlife and humans through food or water consumption.

The proposed activities for this program element include defining background contaminant levels in sediments, analyzing sediment samples to support the five year SWQD watershed permitting strategy, prioritizing remediation efforts, measuring long-term trends at core river and inland lake stations, and conducting sediment toxicity tests as necessary. The funding required to implement these activities is summarized in Table 3.5.

**Table 3.5. Existing and Enhanced Funding Levels--Sediment Chemistry.  
Number of Person Years Are In Parentheses.**

Budget Item	Existing (FY97)	Enhanced
Personnel	\$0 (0)	\$20,000 (0.3)
Analysis and Equipment	\$55,000	\$464,000
Travel	\$1000	\$2,000
Total	\$56,000	\$486,000
Increase		\$430,000

### 3.3.2. Program Element Objectives

The Sediment Chemistry program element addresses seven objectives:

- Objective 1. Determine the chemical character of sediments in the waters of the state.
- Objective 2. Determine whether the chemical character of sediments in the waters of the state is changing with time.
- Objective 3. Determine priority locations for sediment remediation activities in the waters of the state.
- Objective 4. Evaluate the overall effectiveness of the NPDES permit program in reducing contaminant levels in the sediments of the waters of the state.
- Objective 5. Determine background sediment chemical character of the waters of the state.
- Objective 6. Determine whether new chemicals are accumulating in the sediments of the waters of the state.
- Objective 7. Determine the toxicological effects of contaminated sediments on aquatic life.

### 3.3.3. Measurement Endpoints

The chemical character of sediment from the waters of the state will be assessed by measuring one or more of the following indicator parameters in sediment samples collected from different locations throughout the state: arsenic, cadmium, chromium, copper, mercury, nickel, lead, zinc, organic chemicals, Kjeldahl nitrogen, total phosphorus, total solids, % total volatile solids, particle size, and total organic carbon.

The suite of indicator parameters to be measured at any particular site depends upon the reason(s) that site was selected for monitoring.

#### 3.3.4. Monitoring Activities

The specific monitoring activities proposed for inclusion under the Sediment Chemistry program element fall into three categories:

##### **Five Year Basin Sampling**

Each year, in conjunction with biosurveys, sediment samples will be collected from targeted watersheds at 275 sites (245 potentially contaminated sites, 30 background sites) and analyzed for indicator chemicals. This monitoring effort will be used to assess known or suspected areas of contamination, identify priority locations for remediation, and establish background sediment chemical character for the targeted watershed.

Existing vs. New Activity: This monitoring activity is currently performed at a reduced level of effort by the SWQD. The proposed enhancement substantially expands the number of sites and chemicals to be monitored.

Anticipated Cost: \$264K (\$16K for 0.25 person years, \$247K analytical and equipment, \$1K travel).

##### **Trend Monitoring**

A sediment trend monitoring program will be implemented to measure changes in sediment chemistry over time and evaluate the effectiveness of water pollution control efforts. This trend monitoring program will consist of: (1) collection of sediment core samples from 60-70 lakes once every 10 years and analysis of select portions of the core for indicator chemicals; and (2) collection of sediment grab samples at 20 core river stations every five years and analysis for indicator chemicals. Many of these core river stations will be the same as those used by other program elements for trend monitoring.

Existing vs. New Activity: This monitoring activity is not currently performed and represents a new initiative.

Anticipated Cost: \$102K (\$4K for 0.05 person years; \$97K analytical and equipment; \$1K travel).

##### **Toxicity Testing**

Hyalella azteca 10 day survival tests and Chironomus tentans 10 day survival and growth tests will be conducted at 20 sites where sediment chemical analysis has revealed a potential for biotic impairment.

Existing vs. New Activity: This activity is not currently being performed and represents a new initiative.

Anticipated Cost: \$120K (\$120K analytical and equipment).

### **3.4. BIOLOGICAL INTEGRITY AND PHYSICAL HABITAT**

#### **3.4.1. General Information**

This program element includes all monitoring conducted for fish and benthic invertebrate community structure, nuisance aquatic plants, algae, and slimes, and assessment of physical habitat. Because biological communities integrate the cumulative effects of multiple environmental stresses, this element is an important tool for evaluating water quality.

SWQD staff now evaluates 200 wadable stream sites each year for biological integrity and physical habitat quality. Site condition is measured using an index which integrates fish and/or benthic community data and habitat information. Sites are sampled consistent with the SWQD's watershed permitting process, so that data are available when the NPDES permits in that basin come up for renewal. Currently, only about 2.5% of the state's wadable stream miles are sampled each year. The goal of the enhanced monitoring program is to expand sampling coverage of Michigan waters from the current 12% of stream miles over five years to 80%. This increase in coverage will be accomplished by: (1) conducting more rapid assessments at some sites (e.g. limit biota collections to invertebrates); (2) conducting full biological and habitat assessments only at those sites where a problem is suspected based on screening or existing data; and (3) increasing reliance on data collected by federal, state, tribal, Canadian, and local agencies, industry, and citizen volunteers. In addition, an index for nonwadable streams, which currently does not exist, will be developed and tested. The increased funding necessary to carry out these activities is summarized in Table 3.6.

**Table 3.6. Existing and Enhanced Funding Levels--Biological Integrity and Physical Habitat. Number of Person Years Are In Parentheses.**

Budget Item	Existing (FY97)	Enhanced
Personnel	\$260,000 (4.0)	\$585,000 (9.0)
Grant Funds	\$0	\$25,000
Travel	\$5,000	\$18,000
Total	\$265,000	\$628,000
Increase		\$363,000

#### **3.4.2. Program Element Objectives**

The Biological Integrity and Physical Habitat program element addresses eight objectives:

- Objective 1. Assess the biological integrity of the waters of the state.
- Objective 2. Determine whether the biological integrity of specific waters of the state is attaining standards.



- Objective 3. Determine whether sedimentation in the waters of the state is harmful to indigenous aquatic life.
- Objective 4. Determine whether the biological integrity of the waters of the state is changing with time.
- Objective 5. Determine whether BMPs and other restoration efforts are effective in protecting and/or restoring biological integrity and physical habitat.
- Objective 6. Evaluate the overall effectiveness of MDEQ programs in protecting the biological integrity of the waters of the state.
- Objective 7. Identify waters of the state that are high quality and those that are not meeting standards.
- Objective 8. Identify the waters of the state that are impacted by nuisance aquatic plants, algae, and bacterial slimes.

### 3.4.3. Measurement Endpoints

Biological integrity and sediment deposition will be measured using the following indicators:

- fish and invertebrate community indices and habitat assessment (substrate, riparian vegetation, flow, bank stability, riffle:pool)
- Cladophora/Rhizoclonium stringers > 10 inches with a riffle area coverage > 25%; rooted macrophyte abundance impairing designated uses; presence of bacterial slimes
- sedimentation endpoints based on cobble embeddedness

### 3.4.4. Monitoring Activities

Three monitoring activities are proposed under the Biological Integrity and Physical Habitat program element:

#### **Wadable and Nonwadable Biosurveys**

Each year, the biological integrity and physical habitat quality of targeted watersheds will be evaluated by: (1) performing GLEAS Procedure 51 biosurveys on wadable streams; (2) developing and implementing a procedure for measuring the biological integrity of nonwadable waters; (3) screening sites for attainment of standards using data collected by other agencies and citizens; and (4) conducting special biological investigations on selected waterbodies; (5) performing sedimentation assessments on wadable and nonwadable streams; and (6) performing nuisance aquatic plant, algal, or slime investigations on streams and lakes. Watersheds will be targeted for sampling consistent with the SWQD's watershed permitting process. SWQD watershed teams, the SWQD Nonpoint Source Management Team, local government, and other groups will continue to be involved in selecting sampling sites. Citizen volunteers will be used where possible.

Existing vs. New Activity: Biosurveys in wadable streams are existing activities, while the development and implementation of a procedure for assessing nonwadable streams is a new activity, as is site screening for attainment of standards. Special biological studies are currently

conducted on a limited basis, while the proposal described above allows for more effort for this activity as necessary.

Anticipated Cost: \$535K (\$520K for 8.0 person years; \$15K travel).

### **Trend Monitoring**

Every five years, 15 trend monitoring sites will be sampled to evaluate changes in biological integrity. Some of these sites likely will include trend stations established for other program elements. SWQD staff will adopt procedures similar to those being used to assess trends by USGS in the NAWQA program, allowing the two agencies to share comparable data.

Existing vs. New Activity: This activity is not currently being performed and represents a new initiative.

Anticipated Cost: \$68K (\$65K for 1.0 person years; \$3K for travel).

### **Research Grants**

Grant funding to universities will be provided on a yearly basis to evaluate methods and data, test the scientific and statistical validity of metrics, and research new methods. This research would help strengthen the scientific underpinnings of biological assessment.

Existing vs. New Activity: This activity is not currently being performed and represents a new initiative.

Anticipated Cost: \$25K (grant funds to university).

## **3.5. WILDLIFE CONTAMINANTS**

### **3.5.1. General Information**

The proposed Wildlife Contaminant Monitoring Program (WCMP) is a new monitoring program for toxic chemicals in wildlife that rely on aquatic food webs for a substantial portion of their food. The monitoring outlined in the WCMP will be coordinated with other agencies, universities, non-profit organizations, and volunteer and sportsman's groups throughout Michigan. The funding necessary to carry out the wildlife monitoring activities is summarized in Table 3.7.

**Table 3.7. Existing and Enhanced Funding Levels--Wildlife Contaminants. Number of Person Years Are In Parentheses.**

Budget Item	Existing (FY97)	Enhanced
Personnel	\$0 (0)	\$53,000 (0.8)
Analysis and Equipment	\$0	\$345,000

Travel	\$0	\$7,000
Total	\$0	\$405,000
Increase		\$405,000

### 3.5.2. Program Element Objectives

The Wildlife Contaminants program element addresses six objectives:

- Objective 1. Determine contaminant levels in wildlife that may be exposed to contaminants from the waters of the state.
- Objective 2. Determine whether contaminant levels in wildlife are changing with time.
- Objective 3. Evaluate the overall effectiveness of MDEQ programs in protecting wildlife from toxic contaminants from the waters of the state.
- Objective 4. Assist in the identification of waters that may exceed standards and target additional monitoring activities.
- Objective 5. Assist the MDCH in the establishment or removal of wildlife consumption advisories.
- Objective 6. Determine whether new chemicals are bioaccumulating in wildlife.

### 3.5.3. Measurement Endpoints

The uptake of toxic contaminants will be assessed by measuring contaminant levels and effects in wildlife tissues, blood/plasma, or eggs collected throughout the state of Michigan. Wildlife to be monitored will include bald eagle, mink, herring gull, amphibians, and snapping turtles. Parameters include analytical chemistry and associated biomarkers.

### 3.5.4. Monitoring Activities

The proposed WCMP includes five categories of monitoring activities:

#### **Bald Eagles**

Each year, bald eagles will be sampled in targeted watersheds consistent with SWQD's watershed permitting process. Nestling plasma and breast feathers will be analyzed for organochlorine compounds, metals, and associated biomarkers to assess spatial and temporal trends in the levels of these contaminants, and to evaluate potential adverse effects. Livers (from eagles found dead) also will be analyzed.

Existing vs. New Activity: No MDEQ monitoring program currently exists. The MDNR collaborates with the USFWS and Lake Superior State University to collect, archive, and analyze unhatched eggs and plasma. Establishment of a trend monitoring protocol is a new proposal and will supplement the fish contaminant monitoring program by determining the transfer of contaminants to fish-eating wildlife.

Anticipated Cost: \$117K (\$13K for 0.2 person years; \$102K analytical and equipment; \$2K travel).

## **Mink**

Each year, mink will be collected in targeted watersheds, consistent with the SWQD's watershed permitting process. Mink habitats include rivers, streams, lakes, and marshes. Livers, kidneys, femurs, and muscle tissue will be analyzed for organochlorine compounds, metals, and associated biomarkers. These data will be used to assess trends and evaluate contaminant effects.

Existing vs. New Activity: This activity is not currently being performed and represents a new initiative.

Anticipated Cost: \$134K (\$13K for 0.2 person years; \$119K analytical and equipment; \$2K travel).

## **Herring Gulls**

Each year, herring gull eggs will be analyzed for selected toxic pollutants in targeted watersheds, consistent with SWQD's watershed permitting process. This monitoring activity will be coordinated with the Canadian Wildlife Service.

Existing vs. New Activity: No MDEQ sampling or monitoring program currently exists. The Canadian Wildlife Service analyzes eggs from some Michigan and Canadian colonies.

Anticipated Cost: \$61K (\$13K for 0.2 person years; \$47K analytical and equipment; \$1K travel).

## **Amphibian Pilot Study**

An amphibian pilot study will be conducted on the Saginaw Bay watershed. Five sites initially will be chosen on the basis of distribution maps developed by MDNR and known areas of high pesticide use. Other sites will be added in areas where deformed amphibians are found or in other areas of known high pesticide use. Egg masses and whole body will be analyzed for organochlorine compounds and herbicides.

Existing vs. New Activity: MDNR conducts annual frog call surveys. Regional monitoring programs exist to determine abundance, distribution, and deformities. Development of a pilot trend and tissue contaminant monitoring program is a new activity.

Anticipated Cost: \$40K (\$7K for 0.1 person years; \$32K analytical and equipment and; \$1K travel).

## **Snapping Turtle Pilot Study**

Snapping turtle muscle tissue will be collected from watersheds throughout the state and analyzed for selected toxic pollutants to determine the need for consumption advisories. Primary habitats are ponds, lakes, marshes and slow flowing rivers.

Existing vs. New Activity: No MDEQ sampling or monitoring program currently exists. The Canadian Wildlife Service conducts some sampling for contaminants analysis.

Anticipated Cost: \$53K (\$7K for 0.1 person years; \$45K analytical and equipment; \$1K travel).

### **3.6. BATHING BEACH MONITORING**

#### **3.6.1. General Information**

The Michigan Water Quality Standards (WQS) contain numerical criteria for E. coli as an indicator of the potential human health risk from partial and total body contact recreation, which is defined as a designated use of the waters of the state. Although the public bathing beach section of the Public Health Code references the WQS, the Code does not authorize the state to monitor bathing beaches. Furthermore, the Code states that local health departments may test and otherwise evaluate the quality of the water at bathing beaches open to the public. That is, the bathing beach Public Health Code is permissive in allowing testing, but is not mandatory in requiring testing. The authority to close public bathing beaches also rests with the local health departments. The SWQD's primary role regarding bathing beaches will be compiling data to determine overall water quality, and to support those agencies (i.e., local and county health departments) who use the information for decisions regarding beach closings and other activities. The funding necessary to carry out the bathing beach monitoring activities is summarized in Table 3.8.

**Table 3.8. Existing and Enhanced Funding Levels--Bathing Beach Monitoring.  
Number of Person Years Are In Parentheses.**

Budget Item	Existing (FY97)	Enhanced
Personnel	\$0 (0)	\$33,000 (0.5)
Analysis and Equipment	\$0	\$113,000
Travel	\$0	\$0
Total	\$0	\$146,000
Increase		\$146,000

#### **3.6.2. Program Element Objectives**

The Bathing Beach Monitoring program element addresses two objectives:

Objective 1. Determine whether waters of the state are safe for total body contact recreation.

Objective 2. Evaluate the effectiveness of MDEQ programs in protecting the waters of the state from bacteria and E. coli contamination.

### 3.6.3. Measurement Endpoints

The following indicators will be used to measure whether the objectives are being met:

- E. coli concentrations in the water column
- number of beach closings
- number of standards violations

### 3.6.4. Monitoring Activities

One monitoring activity is proposed under the Bathing Beach Monitoring program element:

#### **Database Development and Maintenance**

A statewide database of ambient bathing beach monitoring data will be created and maintained. Staff will work with public health departments and other external groups to design bathing beach monitoring programs, oversee special studies, oversee any contracts, and compile reports on E. coli contamination. In addition, monitoring of selected public beaches will be conducted. This sampling will cover the warm weather months (June-August), and will include enough sampling at individual sites to determine compliance with the instantaneous and 30-day average E. coli standards.

Existing vs. New Activity: This is a new activity. SWQD does not currently devote staff time to monitoring bathing beach contamination or managing such data.

Anticipated Cost: \$146K (\$33 K for 0.5 person years, \$113K analytical and equipment).

## **3.7. INLAND LAKE QUALITY AND EUTROPHICATION**

### 3.7.1. General Information

This program element establishes a Cooperative Lakes Monitoring and Assessment Program (CLMAP) that integrates citizen volunteer monitoring activities with statewide water quality assessment efforts for the protection of biotic integrity and water quality in Michigan's inland lakes.

Recent reductions in federal funding have adversely impacted the MDEQ's inland lakes management program. This funding was the MDEQ's primary support for work with local government and citizen groups to collect water quality data on lakes and to implement comprehensive lake watershed management projects.

The CLMAP will integrate statewide lake monitoring with citizen volunteer monitoring activities and encourage innovative partnerships between the state, local government, and citizens in the management

of lake resources and their watersheds. The funding necessary to implement this program element is summarized in Table 3.9.

**Table 3.9. Existing and Enhanced Funding Levels--Inland Lake Quality and Eutrophication. Number of Person Years Are In Parentheses.**

Budget Item	Existing (FY97)	Enhanced
Personnel	\$65,000 (1.0)	\$294,000 (4.5)
Analysis and Equipment	\$40,000	\$131,000
Travel	\$1,000	\$24,000
Total	\$106,000*	\$449,000 plus \$80,000 start-up
Increase		\$529,000

\* Federal funds which will end after FY97

### 3.7.2. Program Element Objectives

The Inland Lake Quality and Eutrophication program element addresses eight objectives:

- Objective 1. Determine the trophic conditions of the inland lakes in the state.
- Objective 2. Determine whether inland lake quality in the state is changing with time.
- Objective 3. Support MDEQ's watershed and lake management programs for protecting inland lake quality in the state.
- Objective 4. Determine the overall effectiveness of MDEQ's watershed and lake management programs in protecting inland lake quality in the state.
- Objective 5. Identify inland lakes in the state that are high quality waters.
- Objective 6. Identify inland lakes in the state that are not meeting standards.
- Objective 7. Determine whether exotic species are degrading inland lake quality in the state.
- Objective 8. Identify emerging problems through inland lake quality assessments.

### 3.7.3. Measurement Endpoints

Inland lake quality status and trends will be assessed by measuring one or more of the following indicator parameters at target lakes throughout the state: Secchi depth transparency, chlorophyll *a*, nitrogen, phosphorus, dissolved oxygen, temperature, color, conductivity, hardness, pH, acid-neutralizing capacity, alkalinity, total dissolved solids, total suspended solids, major cations (Ca, Mg, Na, K), major anions (Cl, SO<sub>4</sub>), silica, macrophytes, phytoplankton assemblage, periphyton, zooplankton assemblage, shore zone characteristics, littoral zone characteristics, watershed characteristics, and lake morphometry.

The suite of indicator parameters to be measured at a target lake will be determined by the specific monitoring objective(s) for that lake.

### 3.7.4. Monitoring Activities

Three monitoring activities are proposed under the Inland Lake Quality and Eutrophication program element:

### **Trophic Status Monitoring**

The Trophic Status Monitoring component is a modification and expansion of the current Self-Help citizen volunteer monitoring program which has been in existence for over 22 years and will end in FY97 when federal funds are depleted. This component is structured in a hierarchy of three levels of effort (Lake Transparency, Trophic Status Index-TSI, Water Quality Profile) based on the number of indicators sampled and the spatial and temporal monitoring framework. Volunteer participation determines which lakes are monitored. Approximately 300 lakes will be enrolled in the Lake Transparency program, 100 lakes in the TSI program, and 30 lakes in the Water Quality Profile program each year.

The Trophic Status Monitoring component will be administered jointly, via a Memorandum of Understanding, by the MDEQ and the nonprofit, citizen-based Michigan Lake and Stream Associations, Inc. (ML&SA). Data collected under this component will be used to educate and involve citizens in lake quality management issues, to estimate Carlson TSI values for lake trophic status classification, and to determine apparent lake transparency trends.

Existing vs. New Activity: This activity enhances the trophic status monitoring performed by the LWMD and citizen volunteers. It should be noted that funding for the existing program (federal funds) will end after FY97.

Anticipated Cost: \$107K (\$72K for 1.1 person years, \$29K analytical and equipment, \$6K travel) plus \$31K first year start-up.

### **Lake Quality Assessment**

The Lake Quality Assessment Monitoring component is a continuation of a statewide minimum monitoring program for Michigan's inland lakes that will end in FY97 when federal funds are depleted. Lake quality assessment surveys will be conducted during spring turnover and summer stratification periods for lakes with significant resource value. This effort will be coordinated with the SWQD's watershed permitting process.

Data collected under this component will be used to identify lake trophic status, regional lake quality characteristics, and changes in lake quality conditions. These data also will determine water quality standards and designated use impairments. These data will be used to satisfy CWA Sec. 314 and 305(b) requirements and to support watershed and lake management programs for protecting inland lake quality in the state. The Lake Quality Assessment Monitoring component will be integrated with the citizen volunteer Trophic Status Monitoring component to increase monitoring efficiency.



Existing vs. New Activity: This activity enhances the lake quality monitoring performed by the LWMD. It should be noted that funding for the existing program (federal funds) will end after FY97.

Anticipated Costs: \$121K (\$72K for 1.1 person years, \$44K analytical and equipment, \$5K travel) plus \$7K first year start-up.

## **Long Term Lake Trend**

The Long Term Lake Trend Monitoring component establishes a new long term monitoring program to determine lake quality variability and trends within Michigan's ecoregions. Approximately 40 minimally impacted reference lakes will be monitored for long-term lake quality. This program also will provide the necessary reference data set for the Trophic Status Monitoring and Lake Quality Assessment components and serve as the overall QA/QC element for the CLMAP. Data collected under this component will be used to establish lake quality reference conditions for Michigan's inland lakes, identify regional lake quality characteristics, determine lake quality variability and trends, and validate lake quality monitoring and assessment techniques.

Existing vs. New Activity: This activity is not currently being performed and represents a new initiative.

Anticipated Costs: \$221K (\$150K for 2.3 person years, \$58K analytical and equipment, \$13K travel) plus \$42K first year start-up.

## **3.8. STREAM FLOW**

### **3.8.1. General Information**

This proposal is an expansion of an existing long and short term stream flow monitoring program coordinated by the LWMD. It is a cooperative program with federal, state and local participation. Since 1980, the number of continuous long term stream flow monitoring stations operated in Michigan by the USGS has been reduced from 225 to 142 (a 37% decrease). The state currently cooperates with USGS in the funding of 66 of the long term stream flow monitoring stations at a cost of \$304,000. This cost is currently shared by MDEQ (77%), MDOT (14%) and MDNR (9%).

This proposal also would add additional short term sites associated with NPDES permits as well as other unique watershed areas to provide site-specific flow data where previously none existed. Sites would be rotated on a regular basis and correspond to the SWQD's watershed permitting process. Statistical analysis of the flow information provides hydrologic data for water programs for many state, federal, local and private entities. The information will be used to: design bridges and culverts, manage flood plains, issue NPDES permits, analyze dam safety, determine minimum flow releases, and design ground water cleanup and protection strategies. The state has not increased its contribution to the program since the mid 1980's. Inflation has reduced our ability to provide information needed for

MDEQ's permit programs. The funding required for expanded flow monitoring is summarized in Table 3.10.

**Table 3.10. Existing and Enhanced Funding Levels--Stream Flow. Number of Person Years Are In Parentheses.**

Budget Item	Existing (FY97)	Enhanced
Personnel	\$130,000 (2.0)	\$130,000 (2.0)
Analysis and Equipment	\$234,000	\$379,000
Travel	\$0	\$0
Total	\$364,000	\$509,000
Increase		\$145,000

### 3.8.2. Program Element Objectives

The Stream Flow program element addresses three objectives:

- Objective 1. Measure long-term stream flow to support the MDEQ's programs.
- Objective 2. Measure short-term stream flow at NPDES sites where no flow information exists.
- Objective 3. Identify flow variability within watersheds.

### 3.8.3. Measurement Endpoints

The measurement endpoint for the long-term flow monitoring will be a record of daily flows at stations across the state. Flows and stream heights at two hour increments also will be available. The indicator for the short term monitoring will be a set of site-specific flow measurements which can then be used to estimate exceedance flows at a given site and also differences in flow within a watershed.

### 3.8.4. Monitoring Activities

Four monitoring activities are proposed under the Stream Flow program element:

#### **NPDES Support**

Estimates of 95% monthly exceedance flow, harmonic mean flow and the 90 day Q10 flow will be made at 200 sites annually to support NPDES activities.

Existing vs. New Activity: This is an existing activity.

Anticipated Cost: \$65K (\$65K for 1.0 person years).

#### **Nonpoint Source Technical Assistance**

Hydrological modeling and other technical assistance will be provided to state and local agencies involved in nonpoint source (319) projects.

Existing vs. New Activity: This is an existing activity.

Anticipated Cost: \$65K (\$65K for 1.0 person years).

### **Long-Term Flow Measurements**

Long-term flow monitoring stations are needed at 63 sites to adequately represent the various watershed characteristics in Michigan. Adding 20 stations to the current 43 stations would provide long term stream flow monitoring on 63 of Michigan's major watersheds. USGS will be responsible for the data collection and distribution. Flow and stream heights will be collected at 2 hour increments.

Existing vs. New Activity: This proposal is an enhancement of an existing activity. MDEQ currently costs shares with USGS for the operation and maintenance of long term stream flow monitoring stations.

Anticipated Cost: \$334K (\$334K for analysis and equipment). This assumes that a 50/50 match is available from USGS.

### **Short-Term Flow Measurements**

A series of flow measurements will be made near selected NPDES facilities. Stream flow measurements will be made in five different watersheds each year with each watershed having five different sites, for a total of 25 sites. Each site will be operated for two years. There will be 4-6 measurements made at each site each year. USGS will be responsible for the data collection and publishing.

Existing vs. New Activity: This activity is not currently being performed and represents a new initiative.

Anticipated Cost: \$45K (\$45K for analysis and equipment). This assumes that USGS provides a 50/50 match.

## **3.9. VOLUNTEER MONITORING**

Many of the monitoring activities described under the program elements rely upon citizen volunteer monitoring efforts. While there are many volunteer monitoring groups collecting chemical, physical, and biological data from Michigan rivers, streams, and lakes, there currently is no mechanism for SWQD to effectively use such data to screen sites for potential problems.

SWQD will need to devote staff time to the volunteer program. Responsibilities include organizing and training volunteers, providing equipment, developing and implementing quality assurance procedures,

analyzing and reporting data, and giving presentations to the volunteer groups. These activities are described in more detail in Section 5. Funding requirements necessary to ensure the success and value of volunteer monitoring efforts are outlined in Table 3.11.

**Table 3.11. Existing and Enhanced Funding Levels--Volunteer Monitoring. Number of Person Years Are In Parentheses.**

Budget Item	Existing (FY97)	Enhanced
Personnel	\$0 (0)	\$65,000 (1.0)
Analysis and Equipment	\$0	\$10,000
Travel	\$0	\$3,000
Total	\$0	\$78,000
Increase		\$78,000

## SECTION 4

### DATA ANALYSIS AND COMMUNICATION

The benefits of an effective water quality monitoring program are maximized when data are thoroughly analyzed and communicated in meaningful, understandable and timely ways to intended audiences. This requires the documentation and availability of the raw, quality assured data and data summaries. Some data users are interested in raw data, while others are only interested in a summary. Both groups of data users must be accommodated.

#### 4.1. Reporting Raw Data

Raw data generated by the monitoring program elements will be entered into one of the networked, distributed, or centralized data bases listed in Table 4.1. An important goal of the monitoring strategy is to make these data available to interested parties (as read only files) through the Internet. The data management systems will be designed to accommodate raw data as well as information about the data, such as the content, quality, and history of the data. Whenever possible, the data sets will have geographical references and be placed in a geographic information system (GIS) compatible format. Quality assurance and quality control procedures also will be documented and made available.

Table 4.1. Monitoring Data Storage Systems.

<u>Data Type</u>	<u>Data Storage System</u>	<u>New/Existing</u>
Fish Contaminants	ACCESS	Existing
Water Chemistry	STORET	Existing
Sediment Chemistry	STORET	Existing
Sediment Toxicity	ACCESS	New
Biological Integrity	ACCESS	Existing
Physical Habitat	ACCESS	Existing
Nuisance Plants/Algae	ACCESS	New
Wildlife Contaminants	ACCESS	New
Bathing Beaches	ACCESS	New
Inland Lake Quality and Eutrophication	STORET	Existing
Stream Flow	STORET	Existing
Volunteer Monitoring	ACCESS	New

## **4.2. Summary Reports**

The monitoring strategy envisions the production of several reports:

### **1. 305(b) Report**

A major decision-making process that requires an effective monitoring program is the MDEQ's assessment as to whether specific waters of the state are attaining the requirements of the Michigan Water Quality Standards. These decisions are documented every two years in the 305(b) report and the establishment of the nonattainment list. A special section on environmental mercury contamination will be included in the 305(b) report to synthesize and communicate mercury data generated by the monitoring strategy. An inland lake water quality assessment report also is included as part of the 305(b) report to satisfy federal Clean Lakes Program (CWA Section 319) requirements. One intended outcome of the report is to increase awareness of problems and threats to surface water quality in Michigan, as well as identify high quality waters. Mapping techniques will be used to spatially present the current status of water quality in Michigan. This report will also evaluate and discuss spatial and temporal trends in the state's overall water quality. The report is available on the Internet.

### **2. Basin Reports (New)**

The SWQD will evaluate the possibility of summarizing data collected in a watershed in the previous five years into a report. The reports will promote watershed management, and may include GIS analysis of land use, soils, and other factors. These reports will be available prior to NPDES permit work. The audience for these reports is diverse. The reports will provide managers and citizens in the watershed with an understanding of the importance of various water quality issues, and therefore promote more cost effective protection and restoration activities. These reports also will improve awareness of water quality problems and threats, mobilize support to restore polluted streams, and provide protection for high quality streams.

### **3. Fish Contaminant Monitoring Report**

Annual reports are developed to communicate fish contaminant monitoring results to interested parties. Contaminant concentrations in edible portions of fish are compared to existing fish consumption advisories in order to assess the need for changes to the consumption advisories. In addition, contaminant concentrations in whole fish and edible portions are used to assess temporal and spatial trends; evaluate whether fish contaminant problems exist in specific surface waters; and, evaluate whether existing pollution prevention, regulatory, and remedial programs are reducing chemical contamination in the aquatic environment.

The target audience for the annual report includes staff from international, state, federal, tribal and local governments as well as interested and informed representatives from environmental groups and industry, RAP and LaMP citizen advisory groups, consulting firms, and the general public. The edible portion monitoring section of the report will be written primarily for the Michigan Department of Community Health to consider in their annual assessment of public health advisories.

#### 4. Wildlife Contaminant Monitoring Report (New)

Data collected from the wildlife contaminant program element will be summarized in an annual report which will be made available to water quality program managers and other interested parties. Analytical data, effects data, and statistical summaries from the analyses of plasma and tissues will be presented to show temporal and spatial trends in wildlife tissue contaminant concentrations. Results of chemical and biological assays and their correlations to analytical data also will be presented.

#### 5. Sediment Chemistry Report (New)

This report will be published every two years, in coordination with the 305(b) report. This report will include the analytical data for the sediment samples collected during basin surveys, as well as data from trend monitoring stations. The intended audience will be water quality managers at all levels of government and other interested parties.

#### 6. Water Chemistry Trend Report (New)

This report will be prepared every two years, in coordination with the 305(b) report, and will include the analytical chemistry data generated from water chemistry trend monitoring efforts on Saginaw Bay, the Great Lakes connecting channels, and core river stations. Statistical summaries of the data will also be presented to show temporal and spatial trends in water chemistry. The intended audience will be water quality managers at all levels of government and other interested parties.

#### 7. Volunteer Monitoring Report (New)

SWQD will communicate with citizen volunteers about monitoring activities and how their data are being used. These reports may take the form of a newsletter, annual report with data, or other forms of communication. The purpose of these efforts will be to encourage volunteers and other agencies to meet minimum data quality criteria so that volunteer data can be included in the MDEQ decision-making process and databases.

#### 8. Staff Reports

Staff reports provide information on biological, chemical, and physical data in support of many SWQD programs. Programs that benefit from these reports primarily include the NPDES permit program (TMDL development, effluent limits, and enforcement actions) and the nonpoint source program (impacts due to nonpoint sources, enforcement actions, evaluation of BMP effectiveness). The data also are used by local governments, stakeholders, and the public (land use planning, zoning, source identification, site restorations). These reports are written for each individual monitoring project, with approximately 90 completed annually.

## 9. Inland Lake Quality and Eutrophication Reports

Annual reports will be developed under the Cooperative Lake Monitoring and Assessment Program (CLMAP) for the Trophic Status and Lake Quality Assessment monitoring activities. Triennial status reports will be produced for each reference lake under the Long Term Lake Trend Monitoring Component of the CLMAP.

Volunteer monitoring data are reported in an annual summary report for citizen volunteers and other interested parties. This report is produced cooperatively by the Michigan Lake & Stream Associations, Inc. (ML&SA) and the MDEQ. The data are compiled and analyzed to estimate trophic status and evaluate apparent lake quality trends. The report also serves as an educational tool for citizen involvement in lake quality management and watershed planning.

Lake quality assessment monitoring data are compiled, analyzed, and illustrated in an annual report. The data are assessed to determine trophic status for lake classification, high quality lakes, threatened and impaired lakes, and lake quality trends. The lake quality assessments satisfy Clean Lakes Program (CWA Sec. 314) reporting requirements and the results are reported in the biennial 305(b) report. Information summaries and lake quality assessments will be prepared and made available to the public via a MDEQ website on the Internet.

Data collected under the Long Term Lake Trend Monitoring component for each reference lake will be compiled and a report published every three years. These data will establish lake quality reference conditions, identify regional lake quality characteristics, evaluate biotic integrity, determine lake quality variability and trends, and validate lake quality monitoring and assessment techniques. A quality assurance report will be prepared for the entire CLMAP.



## **SECTION 5**

### **INTEGRATION WITH OTHER PROGRAMS AND AGENCIES**

Efficient use of limited resources requires that surface water quality monitoring activities are integrated. Many agencies and groups, from the federal government to individual citizens, have responsibilities and interests in water quality monitoring. Effective implementation of the enhanced monitoring program described in Section 3.0 requires that MDEQ form partnerships with other agencies and groups involved in monitoring, including other state and federal agencies, local governments, tribes, Canadian organizations, universities, industry, environmental groups, and the public. These partnerships will make it possible to more effectively leverage available state funds with those of other public and private organizations.

#### **5.1. Other State Programs and Agencies**

Many state programs and agencies will play a crucial role in site selection and data collection. One of the goals of the monitoring strategy is to support state programs and evaluate their effectiveness. The NPDES, nonpoint source, inland lakes, and RAP/LaMP programs all have monitoring priorities and needs. Similarly, the MDCH advises the MDEQ on locations for collection of fish samples to support the fish consumption advisory process. The MDA is involved in many pesticide and nonpoint source issues. These programs will have considerable involvement in the process of selecting locations and parameters to sample.

The MDNR currently collects many fish and some wildlife for contaminant analysis. MDNR also provides a great deal of information on fish populations. MDEQ and MDNR already work closely to choose sampling locations that mutually benefit both agencies. This cooperation will continue, and with the development of the wildlife contaminants program elements, likely will expand significantly.

#### **5.2. Federal Agencies**

The USEPA is involved in many monitoring activities that complement SWQD's programs. In 1997 and 1998, USEPA Region 5 is scheduled to lead a multi-agency team that will collect fish and invertebrate community data, as well as habitat information, from about 100 stream sites in northern Michigan. This project will collect data analogous to SWQD biological surveys, so SWQD biologists will not have to visit these sites and can survey other sites instead. SWQD will work with USEPA to ensure that sampling methods are comparable, and that data are shared between agencies. Another project led by USEPA Region 5 is the Lake Michigan tributary monitoring project. This effort collected water column data on toxic organic pollutants and trace metals in 1994-95 from seven Michigan tributaries to Lake Michigan. These data will be evaluated to help identify locations and pollutants for water, sediment, and fish tissue analysis. Finally, the USEPA Great Lakes National Program Office collects water and fish tissue data from the open and nearshore waters of the Great Lakes, as well as sediment samples from many tributary mouths.

The USGS, through the National Ambient Water Quality Assessment (NAWQA), is collecting a substantial amount of data from Michigan rivers and streams in the western upper peninsula and in some tributaries to Lake Erie. This project generates data on fish, invertebrate, and algal communities,

physical habitat, and organic and metal contaminants in fish, invertebrates, sediments, and water. USGS already has indicated a desire to work with SWQD biologists to compare collection methods for fish, invertebrates, and algae. SWQD can then rely on USGS data at these locations rather than sending staff to duplicate work. Likewise, USGS can use SWQD data from other sites to further test and refine the hypotheses generated through NAWQA. Data sharing will benefit both agencies. The USGS also collects stream flow data from rivers and streams throughout Michigan.

The USFWS and the Biological Science Division of the USGS (formerly National Biological Service) collect some data on fish and wildlife populations and contaminant levels in Michigan. SWQD will coordinate sampling for fish and wildlife and avoid duplication of effort. Much of the wildlife contaminant monitoring will be done by these agencies, and the MDNR, and incorporated into appropriate reports by MDEQ.

### **5.3. Canadian Agencies**

The federal Environment Canada (EC) and Department of Fisheries and Oceans, and the provincial Ontario Ministry of Environment, monitor the Canadian portion of the Great Lakes and connecting channels. These agencies frequently collect fish, benthic invertebrate, water, and sediment samples from the Canadian waters of the Great Lakes. These data can be combined with MDEQ information collected as a result of this strategy to better evaluate status and trends across Lakes Superior, Huron, and Erie. Wildlife monitoring can be coordinated with Canada, which has an extensive wildlife contaminant monitoring program. The MDEQ will work with Canadian agencies to ensure that methods used to sample and analyze data for all program elements are comparable to facilitate data exchange among agencies.

Monitoring of the connecting channels also provides an excellent opportunity to coordinate activities and share costs with Canadian agencies. The MDEQ and the EC recently initiated the development of a plan to jointly monitor the connecting channels in support of the Remedial Action Plan program, but it was not implemented due to budget constraints. Because this strategy recommends measuring water chemistry in the connecting channels, Canadian agencies should be approached again about participating in this effort. Cooperation would ensure that the data are valuable to all parties, and would be much more cost-effective than conducting separate studies.

### **5.4. Native Americans**

The MDEQ currently cooperates with Native Americans in the monitoring of fish contaminants. Tribes also collect data on water chemistry, fish and invertebrate communities, wildlife, and habitat from reservation waters. The MDEQ will expand efforts to promote the use of comparable methods and data sharing with Native Americans and improve data integration.

### **5.5. Local Government**

One role for local government in the implementation of this strategy is the identification of monitoring locations. Local governments are knowledgeable about existing or emerging problems, and where these problems occur. When SWQD staff plan a watershed survey, local governments are consulted and

their input solicited. In addition, many local governments collect and analyze water quality and biological data for routine or special studies at locations of interest. SWQD will use these data, to the greatest extent possible, to evaluate whether sites are meeting standards. If existing information indicates a potential problem at a site, then a more detailed assessment will be conducted. Because many important environmental decisions are made at the local level, especially in regards to land use planning, it is essential that local governments are full partners in the implementation of this strategy.

Most inland lake management activities in Michigan are initiated and overseen by the local government's Lake Board. These public works boards are a resource management partnership between the state and local government. Membership on Lake Boards include the county commissioner, a township representative, the county drain commissioner, a local citizen, and a MDEQ official. The MDEQ member provides statewide continuity between Boards, expertise in resource management, input on permitting issues, and lake quality data and monitoring guidance.

## **5.6. Citizen Volunteers**

Citizen volunteer monitoring organizations in Michigan currently collect data from streams and lakes. A formal citizen monitoring program, the Self-Help program, has been established by the LWMD for inland lakes. This program has been in existence for over 22 years and is the second oldest citizen volunteer lakes monitoring program in the nation. Over the last few years, the Self-Help program has evolved into a cooperative venture between the Michigan Lake and Stream Association, Inc. and the MDEQ. In this program, volunteers measure lake transparency, nutrients, and aquatic plant communities. Data from the Self-Help program are compiled, evaluated, and reported to the citizen volunteers in an annual report. Michigan's volunteer lakes monitoring program provides the citizens with basic information on their lakes which can be used as indicators of lake productivity. If measured over many years, these data may be useful in documenting changes and trends in lake quality.

While volunteers collect biological, chemical, and physical data from rivers and streams, there is no mechanism currently in place to standardize what each group collects or for SWQD to analyze the data. Several of the program elements require expanded and improved volunteer programs.

The collaborative teams will identify opportunities where citizen volunteers can effectively collect data for use by watershed and other geographic area managers. Citizens currently collect some edible portion and whole fish samples for the fish contaminant monitoring program, and this program can be expanded. Volunteers can monitor streams and Great Lakes shorelines for nuisance aquatic plants and algae. Likewise, the Biological Integrity and Physical Habitat program element suggests that citizen volunteers collect data on fish and invertebrate communities. Citizens can make general habitat assessments and measure stream flow in some instances.

Volunteer biological assessments can be a valuable screening tool to identify and resolve water quality problems. If the screening data suggest a problem or an impaired community, then SWQD biologists can follow up with a site visit and conduct a more detailed investigation. Use of citizen volunteers can free up SWQD staff to focus on those sites that are the most complex and problematic.

One person year is required to implement such an extensive use of citizen volunteers. This request is outlined in Section 3.9. The person year would be used to organize, train, manage, quality assure, and report data collected by volunteers.

## **5.7. Contract Services**

As the implementation of the monitoring program proceeds, the collaborative teams will identify opportunities where the use of contractual services is the most efficient and cost-effective means to accomplish the task. There may be some instances, especially when analyzing fish and sediments for emerging problems (i.e., new chemicals), that the state laboratory does not have the capability to analyze the suite of chemicals for which data are needed. In this situation, SWQD would contract with a private laboratory that does have the ability.